VAISALA

Operating Manual

HMP 130Y Series
Humidity and Temperature Transmitters

EDITION **HMP130Y-O0205-4.3**

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HMP 130Y SERIES HUMIDITY AND TEMPERATURE TRANSMITTERS

1 PRODUCT DESCRIPTION

The HMP 130Y series consists of five humidity and temperature transmitters:

- HMP 131Y, wall installation
- HMP 132Y, duct installation
- HMP 133Y, installation in confined spaces
- HMP 134Y, installation in pressurized spaces
- HMP 135Y, installation in high temperatures.

The HMP 130Y series units incorporate the HUMICAP® sensor, which uses a unique operating principle based on changes in the capacitance of a thin polymer film as it absorbs water molecules.

The humidity measuring range is 0 ... 100 %RH. The output signal is selectable among several standard signals. The temperature is measured with a Pt 100 sensor. (See Chapter 6, and Appendix 1.)

2 INSTALLATION

2.1 Selection of outputs

The transmitters of the HMP 130Y series have a factory setting of 4 ... 20 mA for the temperature and humidity output. If the output is changed, the jumper locations (Figure 1) are changed. The error brought by the jumper change is < 0.15 %FS, making recalibration usually unnecessary. The output signals of the temperature and humidity channels can be selected independent of one another (Appendix 1).

Note: If the temperature output is not used, the output selection jumper must be in position 0.25 ... 1.25 V.

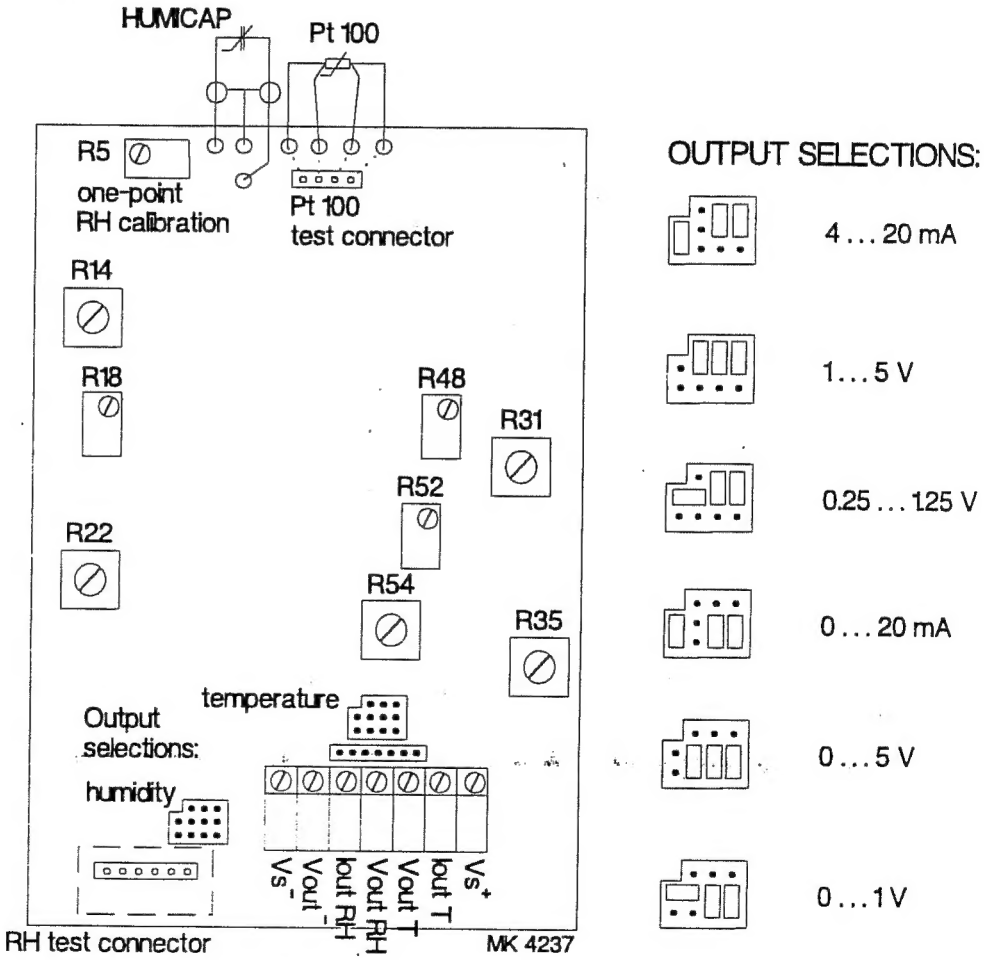


Fig. 1 Output selections, connections and trimming points

2.2 Mounting

The best position for the mounting of the HMP 131Y is with the probe pointing downwards. Due to internal heat transfer, the transmitter should not be mounted with the probe pointing upwards. It is recommended that the other models are mounted with the probe horizontally; any water condensing in the tube can not then reach the sensors.

Install the transmitter in a place where no cold or hot spot can develop. When the sensor head is installed in a duct or channel where temperature is different from the ambient temperature, insulate the point of entry; this is particularly important when the transmitter is installed sensor head pointing downwards. An uninsulated installation can at worst lead to condensation in the sensor head and even when no condensation occurs, the in or out-flowing air changes the temperature near the sensor and so distorts the readings.

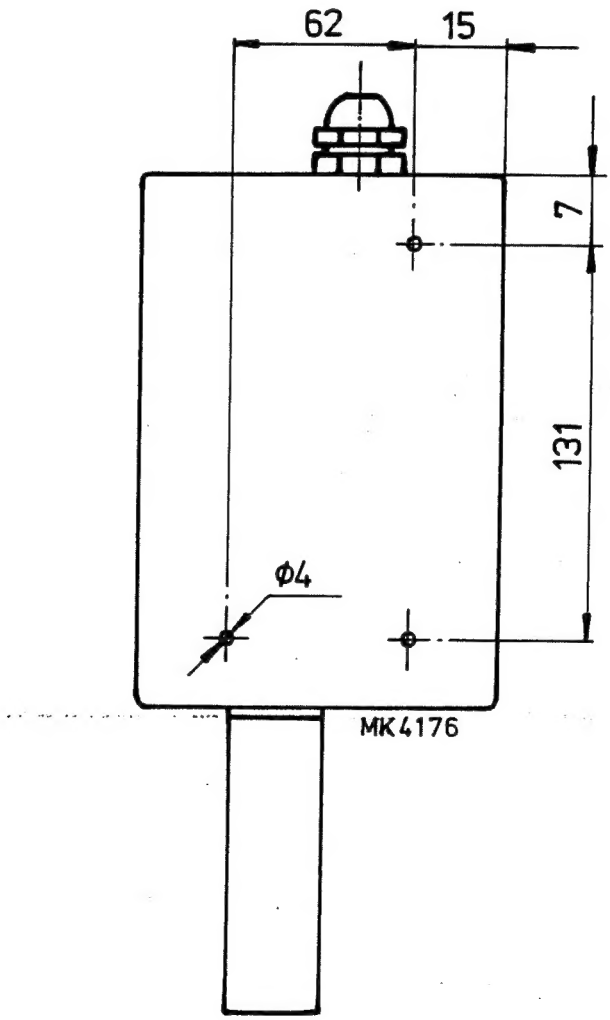


Fig. 2 Mounting holes in the housings of the transmitters

2.3 Electrical connections

Connections recommended for different types of signals are presented in Figures 3, 4, and 5.

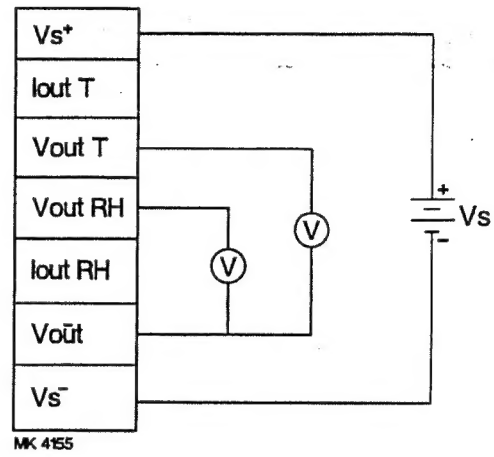


Fig. 3 Connection of voltage signals

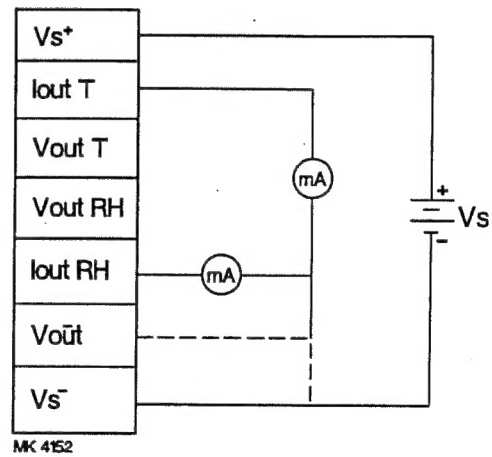


Fig. 4 Connection of current signals

The return wires of current signals can be connected to the negative wire of the power supply in any location, or brought to pole V^-_{out} of the screw terminal.

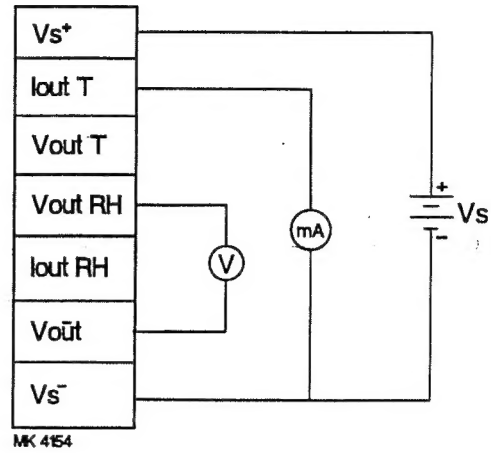


Fig. 5 Recommended connection when the output signals for temperature and humidity are not of the same type

3 TO BE NOTED WHEN MEASURING HUMIDITY

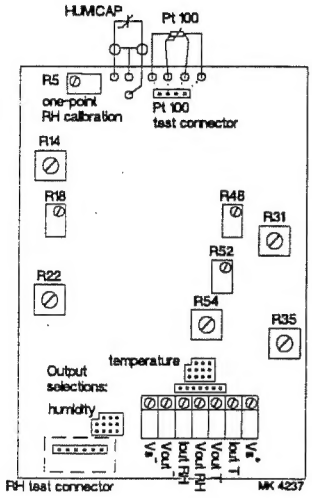
It is essential in the measurement of humidity and calibration to reach temperature equilibrium. Even a small difference in temperature between the measured object and the sensor causes an error. If the temperature is +20 °C (+68 °F) and the relative humidity 50 %RH, a difference of ±1 °C between the measured object and the sensor causes an error of ±3 %RH. When the humidity is 90 %RH, the corresponding error is ±6 %RH.

The error is at its greatest when the sensor is colder than the surroundings and the humidity is high. A temperature difference of a few degrees can cause water to condense on the sensor surface. In an unventilated space evaporation may take hours; ventilation accelerates evaporation. The Humicap sensor starts to function normally as soon as the water has evaporated. If the condensed water is contaminated, the life span of the sensor may shorten and calibration may change.

4 HUMIDITY CALIBRATION

4.1 One-point calibration

The calibration of the humidity and temperature transmitters of the HMP 130Y series should be checked two or three times a year. The interval depends on the operating conditions and the required accuracy. Vaisala's Electronic One-Point Calibrator HMK 20 is recommended for the calibration of these instruments.



Connect the HMK 20 to the instrument to be calibrated (RH test connector, see Figure 1). Make sure the sensors of the instruments are close to one another and switch on the HMK 20 by pushing the red button in position ON.

Switch the black button in position △RH. The indicator now displays the difference in the RH values given by the two devices. Wait until the reading stabilizes and adjust the reading to zero with potentiometer R5 (Figure 1).

Note: **Due to the sensitivity of the potentiometer, Vaisala's calibration screw driver or other plastic screw driver should be used for one-point calibration (potentiometer R5).**

4.2 Salt calibration

4.2.1 General

If a HMK 20 calibrator is not available, the calibration of the instruments of the HMP 130Y series transmitters can be checked with the HMK 11 Calibrator (salt calibration), or sent to Vaisala for service. The probe must be recalibrated every time the humidity sensor Humicap is changed.

4.2.2 Calibration procedure

Connect an ammeter in poles I_{out}RH and V^-_{out}, or a volt meter in poles V_{out}RH and V^-_{out} according to how the output selection jumpers have been set.

Connect the power in poles V_S^+ and V_S^-.

Calibration

- Keep the calibrator and the transmitter for at least 30 minutes in the same space so that their temperatures have time to equalize.
- Place the probe in the calibration hole of the LiCl bottle in the Humidity Calibrator HMK 11.
- Wait for 10 minutes.
- Use potentiometer R5 (offset) to adjust the output signal to the value given in the calibration table (Chapter 4.2.3).
- Place the probe in the calibration hole of the NaCl bottle in the humidity calibrator.
- Wait for 10 minutes.
- Check that the reading corresponds with the desired accuracy to that given in the calibration table. If not, use trimmer R18 to adjust the reading. **Repeat the calibration procedure until the desired accuracy is achieved.**

4.2.3 Calibration table

Temperature	°C	15	20	25	30	35
	°F	59	68	77	86	95
LiCl	%RH	*	11.3	11.3	11.3	11.3
4 ... 20 mA			5.81	5.81	5.81	5.81
0 ... 20 mA			2.26	2.26	2.26	2.26
0.25 ... 1.25 V			0.363	0.363	0.363	0.363
0 ... 1 V			0.113	0.113	0.113	0.113
1 ... 5 V			1.452	1.452	1.452	1.452
0 ... 5 V			0.565	0.565	0.565	0.565
NaCl	%RH	75.6	75.5	75.3	75.1	74.9
4 ... 20 mA		16.10	16.08	16.05	16.02	15.98
0 ... 20 mA		15.12	15.10	15.06	15.02	14.98
0.25 ... 1.25 V		1.006	1.005	1.003	1.001	0.999
0 ... 1 V		0.756	0.755	0.753	0.751	0.749
1 ... 5 V		4.024	4.020	4.012	4.004	3.996
0 ... 5 V		3.780	3.775	3.765	3.755	3.745

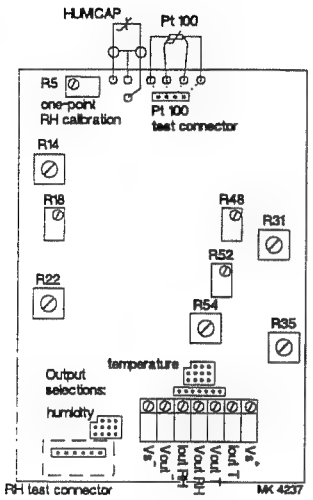
Table 1 Greenspan's calibration table

*) LiCl solution must not be used or stored in temperatures below +18 °C (+64 °F); the equilibrium humidity of the salt solution changes permanently.

5 MAINTENANCE

5.1 Adjustment of temperature channel

5.1.1 Basic calibration with a Pt 100 simulator



If the output is current, set the jumpers in position 4 ... 20 mA (Figure 1). If the output is voltage, set the jumpers in position 0.25 ... 1.25 V or 1 ... 5 V, depending on the voltage range.

Disconnect the wires going to the Pt 100 sensor from the solder lugs of the circuit board.

Connect a Pt 100 simulator in the solder lugs or the Pt 100 connector (Figure 1).

Connect an ammeter in poles $I_{out}T$ and V_s^-, or a volt meter in poles $V_{out}T$ and V^-_{out}.

Connect the power in poles V_s^- and V_s^+.

Set the Pt 100 simulator in the lowest temperature of the temperature range of the instrument which is being calibrated, and use potentiometer R48 to adjust the output signal at its lowest value (4 mA, 0.25 V or 1 V).

Set the Pt 100 simulator in the highest temperature of the temperature range of the instrument which is being calibrated, and use potentiometer R52 to adjust the output signal at its highest value (20 mA, 1.25 V or 5 V).

Repeat the adjustments if necessary. Adjusting potentiometer R48 (offset) always has an effect on the adjustment of potentiometer R52 (gain). Adjusting the R52 does not have a significant effect on the adjustment of the R48 at the low limit (0 °C or -20 °C).

If the Pt 100 simulator does not have the limit values of the measuring range of the instrument which is being calibrated, approximate values can be used as follows:

+150 °C (+302 °F) in the HMP 135Y in the range of 4 ... 20 mA corresponds to the current

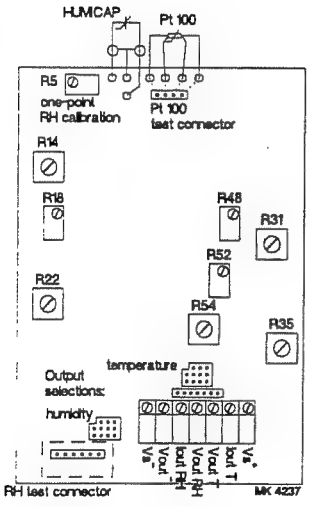
$$\frac{150}{160} \times (20 - 4) + 4 \text{ mA} = 19 \text{ mA}$$

and +50 °C (+122 °F) in the HMP 133Y corresponds to the current

$$\frac{50 + 20}{100} \times (20 - 4) + 4 \text{ mA} = 15.2 \text{ mA}$$

5.1.2 Trimming the nonbiased outputs

The basic calibration (Chapter 5.1.1) must be done before the nonbiased outputs (0 ... 20 mA, 0 ... 1 V or 0 ... 5 V) can be trimmed.



The measuring arrangements are the same as for the basic calibration (Chapter 5.1.1), but the jumpers are set in nonbiased positions (Figure 1).

Set the Pt 100 simulator at a value within the measuring range (e.g. near the temperatures needed in practice) and use trimmer R54 to adjust the reading. For example, +50 °C in the HMP 135Y in the range of 0 ... 20 mA corresponds to current

$$\frac{50}{160} \times 20 \text{ mA} = 6.25 \text{ mA}$$

and in the HMP 133Y

$$\frac{50 + 20}{100} \times 20 \text{ mA} = 14 \text{ mA}$$

Note that the lowest limit of the measuring range cannot be used with this adjustment because the smallest reading obtainable in e.g. the HMP 135Y is approximately 0.1 °C.

5.1.3 Using resistors in the calibration

Instead of a Pt 100 simulator, resistors whose values have been measured precisely (0.1 %, 15 ppm or better) may be used in the calibration of the temperature channel. The following table gives some standard values. The corresponding current or voltage signals are acquired by applying these to the previously given (Chapter 5.1.2) formulas.

Pt 100/Ω	T/°C
160	157.19
158	151.84
150	130.47
140	103.95
130	77.66
121	54.18
120	51.58
110	25.69
100	0.00
93.1	-17.62

Table 2 Standard values for resistors

5.2 Changing the HUMICAP® sensor and the membrane filter

Remove the damaged sensor and insert a new one. Handle the sensor by the plastic socket. DO NOT TOUCH THE SENSOR PLATE. Recalibrate the transmitter.

Replace a dirty membrane filter to ensure a maximum lifetime for the sensor. Do not try to clean the sensor or filter.

6 TECHNICAL DATA

Mechanics

Housing material	ABS plastic
Housing classification	IP 65 (NEMA 4)
Bushing	Ø 5 ... 12 mm (option 8 ... 15 mm)
Dimensions	67 x 92 x 145 mm
Probe lengths	See Figure 6
Sensor protection	(standard):
HMP 131Y	membrane filter (part no. 2787 Ø 18.0 mm)
HMP 132Y	sintered filter (part no. 6686 Ø 18.0 mm)
HMP 133Y	membrane filter (part no. 10159 Ø 12.0 mm)
HMP 134Y & HMP 135Y	sintered filter (Part No. 0195 Ø 12.0 mm)

Electronics

Connections	Screw terminals 0.5 ... 1.5 mm^2 wires (AWG 20 ... 16)
Output*	Operating voltage
4 ... 20 mA 0 ... 20 mA	$11 + \frac{R_L\ (ohm)}{50}$ ... 30 VDC
0.25 ... 1.25 V 0 ... 1 V	11 ... 30 VDC
1 ... 5 V 0 ... 5 V	15 ... 30 VDC
Power consumption	20 ... 60 mA

* Factory setting 4 ... 20 mA. Other outputs selectable by jumpers. Recalibration unnecessary (error produced by jumper change < 0.15 % FS). Recommended operating voltage: the minimum value given above with an increase of 5 V.

Note. If the temperature output is not used, the output selection jumper must be in position 0.25 ... 1.25 V.

External load for current outputs	0 ... 500 Ω
Recommended external load for 1 V voltage output	> 2 kΩ
Recommended external load for 5 V voltage output	> 10 kΩ
Operating temperature (electronics), HMP 131Y	-20 ... +60 °C * -4 ... +140 °F *
Operating temperature (electronics), other models	-5 ... +60 °C * +23 ... +140 °F *
* Upper limit when HPP 130 power supply in use	+55 °C (+131 °F)
Storage temperature	-40 ... +75 °C -40 ... +167 °F

Relative humidity

Measuring range	0 ... 100 %RH
Accuracy maximum achievable accuracy when calibrated against high quality, certified humidity standards:	±1 %RH (0 ... 90 %RH) ±2 %RH (90 ... 100 %RH)
when calibrated against salt solutions (DIN 50 008):	±2 %RH (0 ... 90 %RH) ±3 %RH (90 ... 100 %RH)
Temperature dependence of sensor	additional error less than 2 %RH over the entire temperature range
Temperature dependence of electronics	±0.03 %RH/°C
Response time (90 %) at +20 °C in still air (with sintered filter)	15 s

Sensor:

HMP 131Y, 132Y, 133Y and HMP 134Y	HUMICAP® 0062
HMP 135Y	HUMICAP® 0174

Temperature

Measuring range

HMP 131Y	-20 ... +60 °C -4 ... +140 °F
HMP 132Y, 133Y, 134Y	-20 ... +80 °C -4 ... +176 °F
HMP 135Y	0 ... +160 °C +32 ... +320 °F
Accuracy of electronics at +20 °C (+68 °F)	±0.2 °C
Typical temperature dependence of electronics	±0.005 °C/°C
Linearity of electronics	better than 0.05 °C
Sensor	Pt 100 RTD 1/3 DIN 43760B

Note. **The HMP 134Y is designed for a pressure range of 0 ... 10 MPa.**

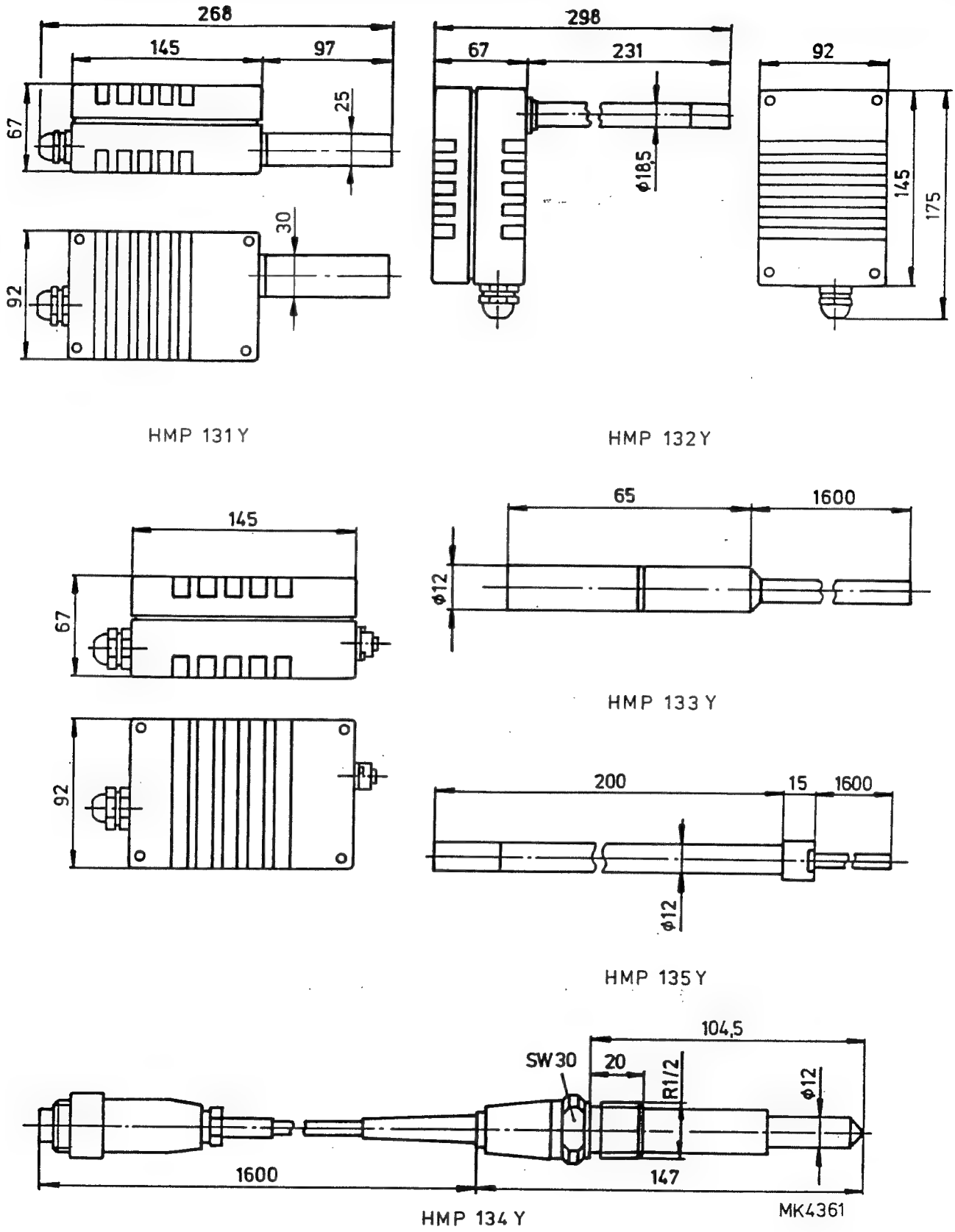


Fig. 6 Dimensions

7 STANDARD ACCESSORY: INSTALLATION FLANGE

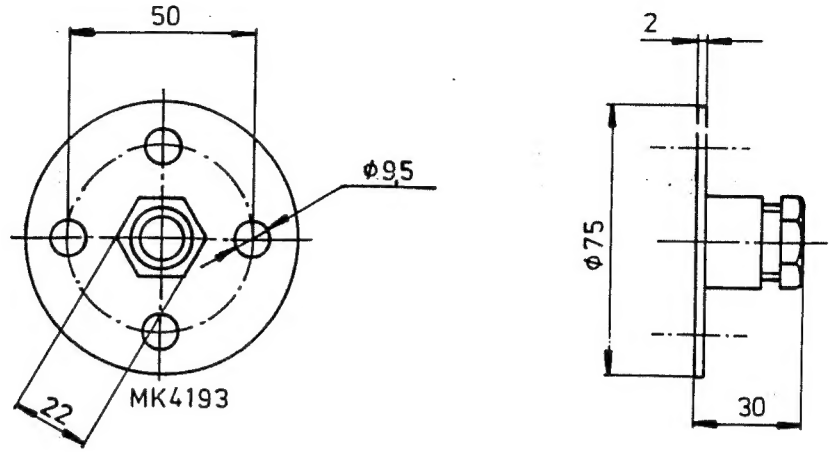


Fig. 7 Mounting Flange for the HMP 135Y

8 OPTION: HPP 130 POWER SUPPLY UNIT

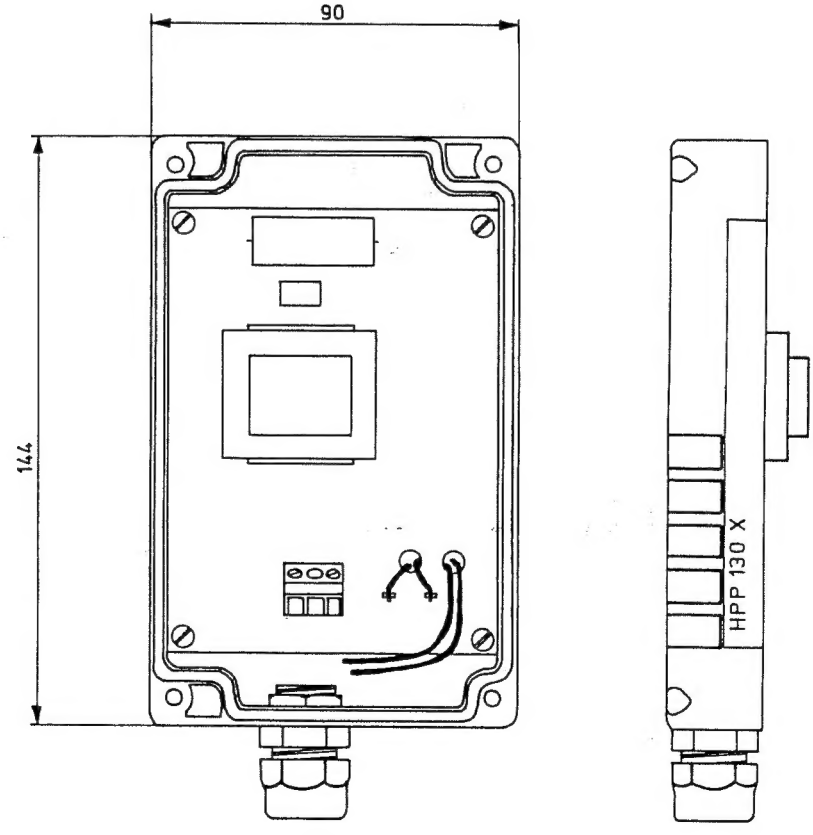


Fig. 8 HPP 130 Power Supply

HPP 130 Power Supply Unit is installed as the cover of HMP 130Y series transmitters.

Supply voltages	
HPP 130A	24 VAC ±10 %, 50/50 Hz
HPP 130B	110 VAC ±15 %, 50/60 Hz
HPP 130C	230 VAC ±15 %, 50/60 Hz
Output voltage	20 VDC nominal/60 mA
Power consumption	1.5 W max.
Operating temperature	-5 ... +55 °C
Input connections	connector 0.5 ... 1.5 mm^2 wires AWG 20 ... 16
Output connections	connection cable
Feed-through	PK7 IP 68 D 4 ... 7 mm
Housing	ABS plastic
Weight	270 g

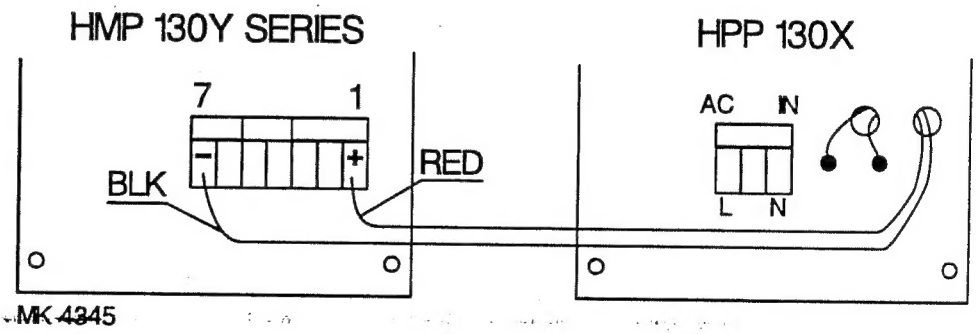


Fig. 9 Electrical connections

9 SPARE PARTS

11990	Mounting flange for the HMP 135Y
2787	Membrane filter 18.0 mm (HMP 131Y)
6686	Sintered filter 18.0 mm (HMP 132Y)
6221	Plastic grid 12.0 mm (HMP 133Y)
0195	Sintered filter 12.0 mm (HMP 134Y, 135Y)
0062	HUMICAP® humidity sensor (HMP 131Y, 132Y, 133Y, 134Y)
0174	HUMICAP® humidity sensor (HMP 135Y)

GUARANTEE

Vaisala issues a guarantee for the material and workmanship of this product under normal operating conditions for one (1) year from the date of delivery. Exceptional operating conditions, damage due to careless handling and misapplication will void the guarantee.

CHANGING THE OUTPUT SIGNALS

Voltages differing from the standard output can be formed in the usual way by measuring the voltage over a known resistance in current form. The internal resistance of the volt meter may, however, cause errors: if it is less than 1000 times the load resistance, the size of error without compensation is over 0.1 %.

In the Series HMP 130Y the additional resistance can be placed so that the voltage output is independent of the load (Figure 1). The value of the additional resistor can be acquired from the following formula:

$$R = (V_o - 1) \times 50\ \Omega$$

when V_o is the maximum output in volts in the range of 0 ... V_o, and the device is connected in current range 0 ... 20 mA.

To retain the performance characteristics of the instrument without recalibration, the accuracy of the additional resistance should be at least 0.1 %, 15 ppm. If recalibration facilities exist, less accurate metal film resistors can be used. For example, the range 0 ... 1.6 V (10 mV/°C for the HMP 135Y) is acquired by the resistor value 30 Ω, and the range 0 ... 10 V by the resistor value 450 Ω. The smallest recommended load in the range 0 ... 10 V is 20 kΩ. For minimum operation voltage, see operation voltages for current outputs. The resistor can be added either on the temperature of humidity channel or both, and the resistors in the latter case may be of different size.

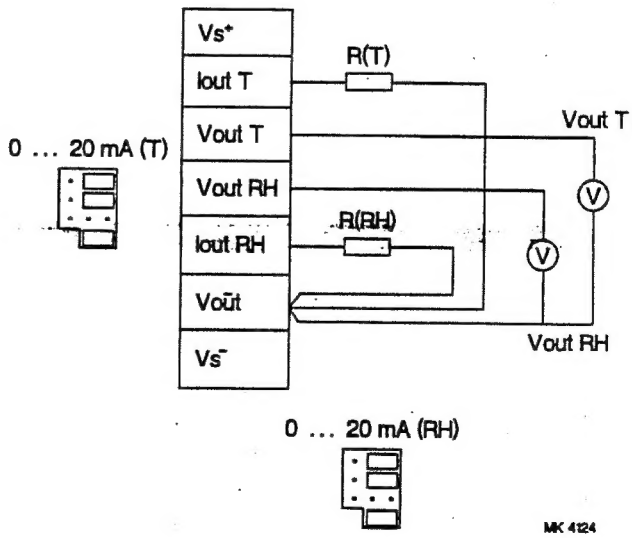


Fig. 1 Connections for changing the voltage outputs